

CLAIMS

What is claimed is:

1. A distributed network management system, comprising:
 - (a) a hub server; and
 - 5 (b) a remote server;
 - (c) said remote server capable of communicating with a network device and said hub;
 - (d) said hub server capable of communicating with said remote server and said network device;
 - 10 (e) wherein
 - (i) if said hub server and said remote server are operational, said hub server communicates with said remote server, and
 - (ii) if said hub server is operational and said remote server is inoperational, said hub server communicates with said network device.
- 15 2. A distributed network management system, comprising:
 - (a) a primary hub server;
 - (b) a secondary hub server; and
 - (c) a remote server;
 - 20 (d) said remote server capable of communicating with a network device, said primary hub server and said secondary hub server;
 - (e) said primary hub server capable of communicating with said remote server and said secondary hub server;
 - (f) said secondary hub server capable of communicating with said remote
 - 25 server and said primary hub server;
 - (g) wherein
 - (i) if said primary hub server and said remote server are operational, said primary hub server communicates with said remote server, and
 - (ii) if said primary hub server is inoperational, said secondary hub server
 - 30 is operational, and said remote server is operational, said secondary hub server communicates with said remote server.

3. A system as recited in claim 2, wherein said primary hub server is capable of communicating with said network device, and wherein if said primary hub server is operational and said remote server is inoperational, said primary hub server communicates with said network device.

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4. A system as recited in claim 2, wherein said secondary hub server is capable of communicating with said network device, and wherein if said primary hub server is inoperational and said remote server is inoperational, said secondary hub server communicates with said network device.

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5. A distributed network management system, comprising:

(a) a hub server;

(b) a primary remote server; and

(c) a secondary remote server;

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(e) said primary remote server capable of communicating with a remote network, said secondary remote server, and said hub server;

(f) said secondary remote server capable of communicating with said remote network, said primary remote server, and said hub server;

(g) said hub server capable of communicating with said primary remote server and said secondary remote server;

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(h) wherein

(i) if said hub server and said primary remote server are operational, said hub server communicates with said primary remote server, and

(ii) if said hub server is operational, said primary remote server is inoperational, and said secondary remote server is operational, said hub server communicates with said secondary remote server.

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6. A system as recited in claim 5, wherein said hub server is capable of communicating with said network, and wherein if said hub server is operational and said primary and said secondary remote servers are inoperational, said hub server communicates with said network device.

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7. A distributed network management system, comprising:
- (a) a primary hub server;
 - (b) a secondary hub server;
 - (c) a primary remote server; and
 - 5 (d) a secondary remote server;
 - (e) said primary remote server capable of communicating with a remote network, said secondary remote server, said primary hub server and said secondary hub server;
 - (f) said secondary remote server capable of communicating with said remote network, said primary remote server, said primary hub server and said secondary hub server;
 - 10 (g) said primary hub server capable of communicating with said secondary hub server, said primary remote server, said secondary remote server, and said remote network;
 - (h) said secondary hub server capable of communicating with said primary hub server, said primary remote server, said secondary remote server, and said remote network;
 - 15 (i) wherein
 - (i) if said primary hub server and said primary remote server are operational, said primary hub server communicates with said primary remote server,
 - 20 (ii) if said primary hub server is operational, said primary remote server is inoperational, and said secondary remote server is operational, said primary hub server communicates with said secondary remote server,
 - (iii) if said primary hub server is operational and said primary and secondary remote servers are inoperational, said primary hub server communicates with said remote network,
 - 25 (iv) if said primary hub server is inoperational, said secondary hub server is operational, and said primary remote server is operational, said secondary hub server communicates with said primary remote server,
 - (v) if said primary hub server is inoperational, said secondary hub server is operational, said primary remote server is inoperational, and said secondary remote server is operational, said secondary hub server communicates with said secondary remote server,
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(vi) if said primary hub server is inoperational, said secondary hub server is operational, and said primary and secondary remote servers are inoperational, said secondary hub server communicates with said remote network, and

5 (vii) if said primary hub server is operational, said secondary hub server is operational, and said primary and secondary remote servers are inoperational, said primary hub server and said secondary hub server communicate with said remote network.

10 8. A distributed network management system, comprising:

(a) a hub server;

(b) a remote server;

(c) said remote server capable of communicating with a network device and said hub;

15 (d) said hub server capable of communicating with said remote server and said network device; and

(e) programming associated with at least one of said servers for carrying out the operations of

20 (i) if said hub server and said remote server are operational, causing said hub server to communicate with said remote server, and

(ii) if said hub server is operational and said remote server is inoperational, causing said hub server to communicate with said network device.

9. A distributed network management system, comprising:

25 (a) a primary hub server;

(b) a secondary hub server;

(c) a remote server;

(d) said remote server capable of communicating with a network device, said primary hub server and said secondary hub server;

30 (e) said primary hub server capable of communicating with said remote server and said secondary hub server;

(f) said secondary hub server capable of communicating with said remote server and said primary hub server; and

(g) programming associated with at least one of said servers for carrying out the operations of

(i) if said primary hub server and said remote server are operational, causing said primary hub server to communicate with said remote server, and

5 (ii) if said primary hub server is inoperational, said secondary hub server is operational, and said remote server is operational, causing said secondary hub server to communicate with said remote server.

10 10. A system as recited in claim 9, wherein said primary hub server is capable of communicating with said network device, and further comprising programming for carrying out the operation of causing said primary hub server to communicate with said network device if said primary hub server is operational and said remote server is inoperational.

15 11. A system as recited in claim 9, wherein said secondary hub server is capable of communicating with said network device, and further comprising programming for carrying out the operation of causing said secondary hub server to communicate with said network device if said primary hub server is inoperational and said remote server is inoperational.

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12. A distributed network management system, comprising:

(a) a hub server;

(b) a primary remote server;

(c) a secondary remote server;

25 (e) said primary remote server capable of communicating with a remote network, said secondary remote server, and said hub server;

(f) said secondary remote server capable of communicating with said remote network, said primary remote server, and said hub server;

30 (g) said hub server capable of communicating with said primary remote server and said secondary remote server; and

(h) programming associated with at least one of said servers for carrying out the operations of

(i) if said hub server and said primary remote server are operational, causing said hub server to communicate with said primary remote server, and

(ii) if said hub server is operational, said primary remote server is inoperational, and said secondary remote server is operational, causing said hub server to communicate with said secondary remote server.

13. A system as recited in claim 12, wherein said hub server is capable of communicating with said network, and further comprising programming for carrying out the operation of causing said hub server to communicate with said network device if said hub server is operational and said primary and said secondary remote servers are inoperational.

14. A distributed network management system, comprising:

(a) a primary hub server;

(b) a secondary hub server;

(c) a primary remote server;

(d) a secondary remote server;

(e) said primary remote server capable of communicating with a remote network, said secondary remote server, said primary hub server and said secondary hub server;

(f) said secondary remote server capable of communicating with said remote network, said primary remote server, said primary hub server and said secondary hub server;

(g) said primary hub server capable of communicating with said secondary hub server, said primary remote server, said secondary remote server, and said remote network;

(h) said secondary hub server capable of communicating with said primary hub server, said primary remote server, said secondary remote server, and said remote network; and

(i) programming associated with at least one of said servers for carrying out the operations of

(i) if said primary hub server and said primary remote server are operational, causing said primary hub server to communicate with said primary remote server,

(ii) if said primary hub server is operational, said primary remote server is inoperational, and said secondary remote server is operational, causing said primary hub server to communicate with said secondary remote server,

5 (iii) if said primary hub server is operational and said primary and secondary remote servers are inoperational, causing said primary hub server to communicate with said remote network,

(iv) if said primary hub server is inoperational, said secondary hub server is operational, and said primary remote server is operational, causing said secondary hub server to communicate with said primary remote server,

10 (v) if said primary hub server is inoperational, said secondary hub server is operational, said primary remote server is inoperational, and said secondary remote server is operational, causing said secondary hub server to communicate with said secondary remote server,

15 (vi) if said primary hub server is inoperational, said secondary hub server is operational, and said primary and secondary remote servers are inoperational, causing said secondary hub server to communicate with said remote network, and

20 (vii) if said primary hub server is operational, said secondary hub server is operational, and said primary and secondary remote servers are inoperational, causing said primary hub server and said secondary hub server to communicate with said remote network.

15. A distributed network management system, comprising:

25 (a) a hub server; and
(b) a remote server;
(c) said remote server capable of communicating with a network device and said hub server;

(d) wherein configuration parameters for said remote server to communicate with said network device can be propagated between said hub server and said remote server
30 bidirectionally.

16. A distributed network management system, comprising:
(a) a network server capable of communicating with a network device; and
(b) means associated with said network server for deriving state information from said network device using LTP.

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17. A system as recited in claim 16, wherein said LTP comprises:
(a) defining a polling interval;
(b) sending, from an ICMP server, a plurality of pings to an interface address on said network device during said polling interval;

10 (c) monitoring the number of pings returned from said network device and converting said number to a percentage based on the number of pings sent;

(d) sending an SNMP query to said network device and determining operational status of said network device from said SNMP query, said operational status comprising "up", "down", and "unknown";

15 (e) using the percentage of pings returned and the SNMP status, generating a status percentage for the polling period by multiplying the percentage pings returned by a constant value associated with said operational status, said constant value comprising a first value if the operational status is "up", a second value if the operational status is "down", and a third value if the operational status is "unknown"; and

20 (f) computing a weighted average of the status percentages for current and previous four polling periods and determining the state of the network device from the weighted average.

18. A system as recited in claim 16, further comprising:

25 (a) means for defining a polling interval;

(b) means for sending, from an ICMP server, a plurality of pings to an interface address on said network device during said polling interval;

(c) means for monitoring the number of pings returned from said network device and converting said number to a percentage based on the number of pings sent;

30 (d) means for sending an SNMP query to said network device and determining operational status of said network device from said SNMP query, said operational status comprising "up", "down", and "unknown";

(e) means for using the percentage of pings returned and the SNMP status, generating a status percentage for the polling period by multiplying the percentage pings returned by a constant value associated with said operational status, said constant value comprising a first value if the operational status is "up", a second value if the operational status is down", and a third value if the operational status is "unknown"; and

(f) means for computing a weighted average of the status percentages for current and previous four polling periods and determining the state of the network device from the weighted average.

19. A system as recited in claim 16, further comprising programming associated with said network server for carrying out the functions of:

(a) defining a polling interval;

(b) sending, from an ICMP server, a plurality of pings to an interface address on said network device during said polling interval;

(c) monitoring the number of pings returned from said network device and converting said number to a percentage based on the number of pings sent;

(d) sending an SNMP query to said network device and determining operational status of said network device from said SNMP query, said operational status comprising "up", "down", and "unknown";

(e) using the percentage of pings returned and the SNMP status, generating a status percentage for the polling period by multiplying the percentage pings returned by a constant value associated with said operational status, said constant value comprising a first value if the operational status is "up", a second value if the operational status is down", and a third value if the operational status is "unknown"; and

(f) computing a weighted average of the status percentages for current and previous four polling periods and determining the state of the network device from the weighted average.

20. A system for deriving state information from a network device, comprising:

(a) a computer; and

(b) programming associated with said computer for carrying out the operations of

(i) defining a polling interval;
(ii) sending, from an ICMP server, a plurality of pings to an interface address on said network device during said polling interval;

5 (iii) monitoring the number of pings returned from said network device and converting said number to a percentage based on the number of pings sent;

(iv) sending an SNMP query to said network device and determining operational status of said network device from said SNMP query, said operational status comprising "up", "down", and "unknown";

10 (v) using the percentage of pings returned and the SNMP status, generating a status percentage for the polling period by multiplying the percentage pings returned by a constant value associated with said operational status, said constant value comprising a first value if the operational status is "up", a second value if the operational status is "down", and a third value if the operational status is "unknown"; and

15 (vi) computing a weighted average of the status percentages for current and previous four polling periods and determining the state of the network device from the weighted average.

21. A method for distributed network management, comprising:

20 (a) providing a hub server;
(b) providing a remote server;
(c) said remote server capable of communicating with a network device and said hub;

(d) said hub server capable of communicating with said remote server and said
25 network device;

(e) if said hub server and said remote server are operational, causing said hub server to communicate with said remote server; and

(f) if said hub server is operational and said remote server is inoperational, causing said hub server to communicate with said network device.

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22. A method for distributed network management, comprising:

(a) providing a primary hub server;
(b) providing a secondary hub server;

- (c) providing a remote server;
- (d) said remote server capable of communicating with a network device, said primary hub server and said secondary hub server;
- (e) said primary hub server capable of communicating with said remote server
5 and said secondary hub server;
- (f) said secondary hub server capable of communicating with said remote server and said primary hub server;
- (g) if said primary hub server and said remote server are operational, causing said primary hub server to communicate with said remote server, and
- 10 (h) if said primary hub server is inoperational, said secondary hub server is operational, and said remote server is operational, causing said secondary hub server to communicate with said remote server.

23. A system as recited in claim 22, wherein said primary hub server is capable
15 of communicating with said network device, and further comprising causing said primary hub server to communicate with said network device if said primary hub server is operational and said remote server is inoperational.

24. A system as recited in claim 22, wherein said secondary hub server is
20 capable of communicating with said network device, and further comprising causing said secondary hub server to communicate with said network device if said primary hub server is inoperational and said remote server is inoperational.

25. A method for distributed network management, comprising:
- 25 (a) providing a hub server;
 - (b) providing a primary remote server;
 - (c) providing a secondary remote server;
 - (e) said primary remote server capable of communicating with a remote network, said secondary remote server, and said hub server;
 - 30 (f) said secondary remote server capable of communicating with said remote network, said primary remote server, and said hub server;
 - (g) said hub server capable of communicating with said primary remote server and said secondary remote server;

(h) if said hub server and said primary remote server are operational, causing said hub server to communicate with said primary remote server; and

(i) if said hub server is operational, said primary remote server is inoperational, and said secondary remote server is operational, causing said hub server to communicate
5 with said secondary remote server.

26. A method as recited in claim 25, wherein said hub server is capable of communicating with said network, and further comprising causing said hub server to communicate with said network device if said hub server is operational and said primary
10 and said secondary remote servers are inoperational.

27. A method for distributed network management, comprising:

- (a) providing a primary hub server;
- (b) providing a secondary hub server;
- 15 (c) providing a primary remote server;
- (d) providing a secondary remote server;
- (e) said primary remote server capable of communicating with a remote network, said secondary remote server, said primary hub server and said secondary hub server;
- 20 (f) said secondary remote server capable of communicating with said remote network, said primary remote server, said primary hub server and said secondary hub server;
- (g) said primary hub server capable of communicating with said secondary hub server, said primary remote server, said secondary remote server, and said remote network;
- 25 (h) said secondary hub server capable of communicating with said primary hub server, said primary remote server, said secondary remote server, and said remote network;
- (i) if said primary hub server and said primary remote server are operational, causing said primary hub server to communicate with said primary remote server;
- (j) if said primary hub server is operational, said primary remote server is
30 inoperational, and said secondary remote server is operational, causing said primary hub server communicates with said secondary remote server;
- (k) if said primary hub server is operational and said primary and secondary remote servers are inoperational, causing said primary hub server to communicate with said

remote network;

(l) if said primary hub server is inoperational, said secondary hub server is operational, and said primary remote server is operational, causing said secondary hub server to communicate with said primary remote server;

5 (m) if said primary hub server is inoperational, said secondary hub server is operational, said primary remote server is inoperational, and said secondary remote server is operational, causing said secondary hub server to communicate with said secondary remote server;

10 (n) if said primary hub server is inoperational, said secondary hub server is operational, and said primary and secondary remote servers are inoperational, causing said secondary hub server to communicate with said remote network; and

(o) if said primary hub server is operational, said secondary hub server is operational, and said primary and secondary remote servers are inoperational, causing said primary hub server and said secondary hub server to communicate with said remote
15 network.

28. A method for distributed network management, comprising:

(a) providing a hub server;

(b) providing a remote server;

20 (c) said remote server capable of communicating with a network device and said hub server; and

(d) propagating configuration parameters for said remote server to communicate with said network device between said hub server and said remote server bidirectionally.

25 29. A method for distributed network management, comprising:

(a) providing a network server capable of communicating with a network device; and

(b) deriving state information from said network device using LTP.

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30. A method as recited in claim 29, wherein said LTP comprises:

(a) defining a polling interval;

(b) sending, from an ICMP server, a plurality of pings to an interface address on

said network device during said polling interval;

(c) monitoring the number of pings returned from said network device and converting said number to a percentage based on the number of pings sent;

(d) sending an SNMP query to said network device and determining operational status of said network device from said SNMP query, said operational status comprising "up", "down", and "unknown";

(e) using the percentage of pings returned and the SNMP status, generating a status percentage for the polling period by multiplying the percentage pings returned by a constant value associated with said operational status, said constant value comprising a first value if the operational status is "up", a second value if the operational status is down", and a third value if the operational status is "unknown"; and

(f) computing a weighted average of the status percentages for current and previous four polling periods and determining the state of the network device from the weighted average.

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31. A method for deriving state information from a network device, comprising:

(a) defining a polling interval;

(b) sending, from an ICMP server, a plurality of pings to an interface address on said network device during said polling interval;

(c) monitoring the number of pings returned from said network device and converting said number to a percentage based on the number of pings sent;

(d) sending an SNMP query to said network device and determining operational status of said network device from said SNMP query, said operational status comprising "up", "down", and "unknown";

(e) using the percentage of pings returned and the SNMP status, generating a status percentage for the polling period by multiplying the percentage pings returned by a constant value associated with said operational status, said constant value comprising a first value if the operational status is "up", a second value if the operational status is down", and a third value if the operational status is "unknown"; and

(f) computing a weighted average of the status percentages for current and previous four polling periods and determining the state of the network device from the weighted average.